

SURFACE GENERATION FROM POINT CLOUDS ON SURFACE

T. Taniguchi^a, T.Kodani^a and K. Moriwaki^b

^a Faculty of Environmental Science and Technology, Okayama University
Tsushimaka-naka 3-1-1, Okayama 700-8530, Japan
taniguti@cc.okayama-u.ac.jp & kodani@poo.civil.okayama-u.ac.jp

^b ABAQUS, Inc. 6-10, Edobori 1-chome, Nishi-ku, Osaka, Japan
kiyoaki.moriwaki@abaqus.jp

A surface generation method from point clouds is proposed for FEM user, who has to prepare triangles as to cover the surface of domain. The method is valid for arbitrary 3-dimensional shape, if 1) the domain is covered by smooth surface and 2) points are appropriately placed on the surface and also on all feature lines.

FEM users in engineering field often encounter to create triangles as to cover whole surface of object using point clouds, which are not sufficiently and irregularly distributed on the surface. We assume in this paper that (1) points need not be regularly placed but (2) they must be located on all feature lines. The process of surface triangulation proposed here is very similar to a patch work and it consists of two stages; the first stage is to prepare triangles on smooth surface except points on feature lines, and the second stage is to connect triangulated smooth sub-surfaces at feature lines. This idea obviously requires the selection of points on all feature lines, and the authors propose a method, which is based on the one by Gumhold et al[1]. The difference from Gumhold's assumption is that points must be placed on all feature lines.

Next stage is the triangulation of smooth sub-surface surrounded by feature lines, and it consists of following steps; 1) select neighborhoods from each point, 2) determine starting point of surface triangulation for each sub-surface, and 3) triangulate each sub-surface using points. In 1) we select restricted number of neighbors from each point using distance. The starting point of surface triangulation is determined among points, which do not have any feature points in its neighbors. Surface triangles surrounding a point (P) are generated by 1) selecting points, which locate surely on a same surface, 2) ordering them as to surround P, and 3) forming triangles by using P and two neighbors. These procedures are achieved at the same time. That is, during the selection and ordering of points, the intersecting angle between neighboring two triangles to be generated is examined and only points, which can form smooth triangulated sub-surface, are selected and stored to form triangles. This process can avoid the generation of inappropriate triangle, which is formed by the selection of points on different sub-surfaces. Proposed method is valid for the case, where two sub-surfaces locate in a vicinity. After the triangulation of all sub-surfaces, they are connected at feature lines, and the surface generation is terminated.

One example of the application is shown below. Proposed method may be influenced by the distribution of points on the surface, and the authors give some important remarks on the point distribution for its user.

References

[1] S. Gumhold, X. Wang and R. MacLeod, "Feature extraction from point clouds", pp.293-305, 10IMR, 2001

